Role of PET/CT in diagnosis, staging and follow up of HCC

Essay
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Master Degree in Radiodiagnosis
By

Asmaa Monir Aly
M B, B Ch
Faculty of medicine Cairo Univericity
Resident of radiodiagnosis
Theodor Bilhares research institute

Supervised By

Prof Dr. Hamed Samir El Ghawaby
Professor of Radiodiagnosis
Faculty of Medicine
Cairo University

Dr. Ahmed Abd El Samie Mahmoud
Lecturer of Radiodiagnosis
Theodor Bilhares Research institute

Radiodiagnosis Department
Faculty of Medicine
Cairo University
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Abstract

PET/CT is superior to PET and CT alone, and/or magnetic resonance imaging (MRI), in the diagnosis and treatment of various primary or metastatic cancers.

Dual modality PET/CT scanning provides accurately fused morphologic (CT) and functional (PET) data sets. A very small tumor is well detected by PET but can be missed by CT. On the other hand, a large tumor with minimal functional deviations may be seen on a CT image, but may not be detected by PET. In both situations, PET/CT would localize the tumor accurately. Thus, PET/CT is a more accurate test than either of its individual components.

PET/CT has advantages over other imaging methods; it can differentiate benign from malignant lesions, staging and restaging tumors, detect functional changes before there is any change in clinical or radiological size of a mass, better in identifying cancer that has spread, making up treatment plan and monitoring tumor response, distinguish viable metabolically active tissue from scars, and it is indicated for restaging in patients with suspected recurrent and metastatic disease.

Key words :

PET CT - Hepatitis C Virus - Aflatoxin B .

LIST OF ABBREVIATION

LLS: Left lobe segment donation

FCAT: Federative Committee on Anatomical Terminology

RHV: Right hepatic vein

MHV: Middle hepatic vein

LHV: Left hepatic vein

IVC: Inferior vena cava

MP: Main portal vein

CM: centimeter

SMA :Superior mesenteric artery

CT:Computed tomography

HU:Housfield unit

FL: Falciform ligament

PET: Positiron emitted tomography

FDG: Fluoro Deoxy Glucose

PET CT: Position emission tomography with computed tomography

CNS: Central nervous system

CVS:Cardio vascular system

18F FDG: ^{18}Florine labeled 2 fluro 2 deoxy glucose

GCSF :Granulocyte colony-stimulating factor

HCC:Hepato cellular carcinoma

HCV: Hepatitis C Virus

RNA: Ribonucleic acid

HBV: Hepatitis B Virus

AFB: Aflatoxin B

AFM1: Aflatoxin M1

H&E: Hematoxylin and Eosin

NAFLD: Non-alcoholic fatty liver disease

TNM: Tumor Node Metastasis

UICC: International Union against Cancer

MRI: Magnetic resonant imaging

KEV: Kilo electron volt

MEV: Milli electron volt

PDGF: Platelet Derived Growth Factor

VEGF: Vascular Endothelial Growth Factor

BFGF: Basic Fibroblast Growth Factor

GLUT: Glucose Transporters

PMTs: Photomultiplier tubes

NaI (Tl): Thallium-doped sodium iodide

BGO: Bismuth Germinate

LSO: Lutetium Oxyorthosilicate

GSO: Gadolinium Silicate

SPECT: Single Photon Emission Computed tomography

KV: Killo Volt

LOR: Line of response

18F: Fluorine 18

13N: Nitrogen 13

11C: Carbon 11

15O: Oxygen 15

82Rb: Rubidium 82

β+: Positron

ν: neutrino

γ : Photon

N: neutron

P: proton

H+: Hydrogen ion

Z: Atomic number

MCi: Millicurie

IV: Intravenous

AC/AL: Attenuation correction/Alignment

SUV: Standardized uptake value

CT FOV: Computed Tomography Field of View

AFP: Alfa-fetoprotein

US:Ultrasonography

CO2: Carbon Dioxide

11C-ACT: 11 carbon acetate

BCLC: Barcelona Clinic Liver Cancer

^{18}FDG-6-P: 18 F-FDG-6-phosphate

18 FDGal: 18 fluoro-2-deoxy-D-galactose

FCH : Flurocholine

11C-choline: 11 carbon choline

MDCT: Multi detector computed tomography

TACE: Transarterial chemoembolization

RFA: Radiofrequency ablation

PEI: Percutaneous ethanol injection

PVT: Portal vein thrombosis

PV: Portal vien

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INTRODUCTION

Cancer is a major cause of death in the developed world, and is becoming a significant issue for developing countries ***(Jones et al., 2006)***.

Hepatocellular carcinoma (HCC) is the 5th most common cancer world wide & responsible for up to 1 million deaths annually, its incidence is increasing worldwide because of the dissemination of hepatitis B and C virus infections ***(Huang et al., 2009)***.

Hepatocellular carcinoma (HCC) is globally the commonest liver primary, and cholangiocarcinoma the second commonest primary liver tumour. Cholangiocarcinoma accounts for 3% of all gastrointestinal cancers. Mesenchymal liver tumours are rare, but include hepatic angiosarcoma and primary hepatic lymphoma ***(Vauthey and Blumgart, 2009)***.

The most common malignant tumors in the liver are metastases from wide variety of neoplasms, that most frequently are carcinomas from colorectal, breast, and lung primaries. Often discovered as solitary, liver metastases can be effectively treated with surgery ***(Arciero and Sigurdson, 2008)***.

Surgical treatment ,including hepatic resection and liver transplantation ,are considered as the most effective treatment of HCC.Intervenstional treatment have been applied to patients with inoperable HCC.Despite initial remission of HCC after surgical and interventional treatment ,recurrence is common. Since patients with recurrent HCC may be amenable to potentially curative resection, early detection of intrahepatic recurrence and /or extra hepatic metastases is extremely important and can facilitate successful retreatment at an early stage ***(Sun et al., 2009)***.

Modern cross sectional structural imaging techniques like ultrasonography, computed tomography (CT) and magnetic resonance imaging(MRI)provide high resolution images that aid in accurate detection, delineation and anatomic localization of the liver malignancies. However, characterization of lesions into benign and malignant etiologies is often not possible from structural imaging techniques alone. Although functional imaging techniques like positron emission tomography (PET) with radiolabeled 18F labeled

2-fluoro-2-deoxy-D-glucose (18F-FDG) often provide critical information pertaining to a benign or malignant etiology, anatomic localization of abnormal regions of uptake is often problematic due to inadequate spatial resolution. These circumstances make the combination of PET with CT appealing. It has the potential of offering a comprehensive ,one-stop, examination by providing information about lesion etiology based on functional activity on PET scanning along with precise anatomic localization and other morphological features of the abnormality with CT scanning ***(Wahl , 2004) (Daniet et al., 2010)***.

The reported increase in sensitivity of (^{18} F-FDG PET /CT) over CT and MRI has been attributed to the ability to of (^{18} F-FDG PET /CT) to detect metabolic abnormalities that precede the morphological changes by CT ***(Sun et al., 2009)***.

^{18}F FDG PET /CT has been routinely applied to the assessment of patients with HCC before liver transplantation, also after transplantation it could provide addional information beyond that provided by conventional modalities and contribute to the clinical management of HCC recurrence ,especially in patients with extra hepatic recurrence ***(Kim et al.,2010)***.

PET/CT can provide added diagnostic information compared with conventional imaging in patients after radiofrequency ablation of liver tumors and can be useful in guiding repeat ablation procedures ***(Barker et al., 2005)***.

Advances in imaging technology have improved our ability to detect, characterize, and stage malignant liver tumors. PET/CT therefore possibly proved superior to CT alone when assessing liver cancer ***(Veit et al., 2006)***.